Entergy

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Fred Dacimo
Site Vice President
Administration

January 15, 2007
Indian Point Unit No. 2
Docket No. 50-247
NL-07-002

Document Control Desk
U.S. Nuclear Regulatory Commission
Mail Stop O-P1-17
Washington, DC 20555-0001

Subject: Licensee Event Report # 2006-005-00, "Automatic Reactor Trip Due to a Turbine Trip as a Result of a Main Generator Exciter Protective Trip Caused by a Generrex Power Supply Loss of Electrical Ground"

Dear Sir:

The attached Licensee Event Report (LER) 2006-005-00 is the follow-up written report submitted in accordance with 10 CFR 50.73. This event is of the type defined in 10 CFR 50.73(a)(2)(iv)(A) for an event recorded in the Entergy corrective action program as Condition Report CR-IP2-2006-06658.

There are no commitments contained in this letter. Should you or your staff have any questions regarding this matter, please contact Mr. Patric W. Conroy, Manager, Licensing, Indian Point Energy Center at (914) 734-6668.

Sincerely,

Fred R. Dacimo
Site Vice President
Indian Point Energy Center

IE22

Attachment: LER-2006-005-00

cc:

Mr. Samuel J. Collins
Regional Administrator – Region I
U.S. Nuclear Regulatory Commission

U.S. Nuclear Regulatory Commission
Resident Inspector's Office
Resident Inspector Indian Point Unit 2

Mr. Paul Eddy
State of New York Public Service Commission

INPO Record Center

NRC FORM 366 (6-2004) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES: 06/30/2007

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-I0202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME:	2. DOCKET NUMBER	3. PAGE
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4. TITLE: Automatic Reactor Trip Due to a Turbine Trip as a Result of a Main Generator Exciter Protective Trip Caused by a Generrex Power Supply Loss of Electrical Ground

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV. NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
										05000
11	15	2006	2006 -	005 -	00	01	15	2007	FACILITY NAME	DOCKET NUMBER 05000

9. OPERATING MODE

1

10. POWER LEVEL

100%

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: *(Check all that apply)*

- ☐ 20.2201(b)
- ☐ 20.2201(d)
- ☐ 20.2203(a)(1)
- ☐ 20.2203(a)(2)(i)
- ☐ 20.2203(a)(2)(ii)
- ☐ 20.2203(a)(2)(iii)
- ☐ 20.2203(a)(2)(iv)
- ☐ 20.2203(a)(2)(v)
- ☐ 20.2203(a)(2)(vi)
- ☐ 20.2203(a)(3)(i)
- ☐ 20.2203(a)(3)(ii)
- ☐ 20.2203(a)(4)
- ☐ 50.36(c)(1)(i)(A)
- ☐ 50.36(c)(1)(ii)(A)
- ☐ 50.36(c)(2)
- ☐ 50.46(a)(3)(ii)
- ☐ 50.73(a)(2)(i)(A)
- ☐ 50.73(a)(2)(i)(B)
- ☐ 50.73(a)(2)(i)(C)
- ☐ 50.73(a)(2)(ii)(A)
- ☐ 50.73(a)(2)(ii)(B)
- ☐ 50.73(a)(2)(iii)
- ☒ 50.73(a)(2)(iv)(A)
- ☐ 50.73(a)(2)(v)(A)
- ☐ 50.73(a)(2)(v)(B)
- ☐ 50.73(a)(2)(v)(C)
- ☐ 50.73(a)(2)(v)(D)
- ☐ 50.73(a)(2)(vii)
- ☐ 50.73(a)(2)(viii)(A)
- ☐ 50.73(a)(2)(viii)(B)
- ☐ 50.73(a)(2)(ix)(A)
- ☐ 50.73(a)(2)(x)
- ☐ 73.71(a)(4)
- ☐ 73.71(a)(5)
- ☐ OTHER

Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER *(Include Area Code)*
Robin Daley, System Engineer	(914) 734-8817

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO EPIX
B	TL	JX	G080	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

16. ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced type written lines)*

On November 15, 2006, at 1400 hours, with reactor power at 100%, an automatic reactor trip (RT) was initiated as a result of a turbine trip due to a main generator exciter protective trip during troubleshooting of the exciter Generrex power supply. All control rods fully inserted and all required safety systems functioned properly. The plant was stabilized in hot standby with decay heat being removed by the main condenser. There was no radiation release. The Emergency Diesel Generators did not start as offsite power remained available. The Auxiliary Feedwater System automatically started as expected due to Steam Generator low level from shrink effect. A post transient evaluation was performed prior to restart. The apparent cause was believed to be a momentary loss of electrical ground to the alarm cards that monitor primary and redundant Generrex power supplies for the main generator exciter. After replacement of the #1 power supply circuit card, resistance measurements of a pin electrically connected to a common ground resulted in an output spike in the redundant power supply. The operating power supply spiked low dropping the voltage below the trip set point which initiated a main generator exciter protective trip. A screw terminal where the grounds are mounted was found to be loose. Corrective actions included providing proper connections for the common ground, repairs to the Generrex +15V/#1 Power Supply and checking all remaining +/-15 Volt pins and terminal points for proper operation. The Generrex power supply #1 will be replaced with a refurbished power supply. The event had no effect on public health and safety.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

Note: The Energy Industry Identification System Codes are identified within brackets { }

DESCRIPTION OF EVENT

On November 15, 2006, at 1400 hours, while at approximately 100% steady state reactor power, an automatic Reactor Trip (RT) {JC} was initiated as a result of a Turbine Trip (TT) {JJ} due to a Main Generator Exciter {TL} protective trip during troubleshooting of the Exciter Generrex power supply {JX}. An investigation into the cause of the event and a post transient evaluation was initiated.

Prior to the event all Control Rods {AA} were fully withdrawn from the reactor core and in Auto, both Main Boiler Feedwater Pumps (MBFPs) {SJ} were in service, Auxiliary Feedwater Pumps (AFWPs) {BA} were in standby, the Emergency Diesel Generators {EK} were in standby, and off-site power was in service. Prior to the event, surveillance PT-Q63, "Steam Flow/Feed Flow Mismatch Testing," was in progress. Systems that did not perform as expected after the RT included; saturation margin B indicated low, and three IRPI's (K-6, F-14, E-13) did not indicate less than twelve steps on control room indicators. All rod bottom lights illuminated and rod position was verified to be less than twelve steps using the plant computer system (PICS). The TT First Out annunciator was Generator Primary Lock-Out relay 86P. Control Room operators entered emergency operating procedure (EOP) E-0, "Reactor Trip or Safety Injection," and transitioned to EOP ES-0.1, "Reactor Trip Response," and then to plant operating procedure POP-3.2.

At approximately 13:58 hours, troubleshooting was being performed by Instrumentation and Control (I&C) personnel on the Main Generator Exciter Generrex power supply. The troubleshooting included resistance readings on the generator exciter Generrex +15V/#1 Power Supply during which a generator trip signal was initiated. Investigation of the event discovered that during troubleshooting of Generrex +15V/#1 Power Supply, which was out of service (locking in one out of two trip signals), the voltage in the operating power supply (+15V/#2 Power Supply) suddenly spiked low dropping the voltage below the trip set point thereby satisfying the logic for initiating a trip of generator lock-out relay 86P which actuated a TT and subsequently per design a RT. Unit 2 has a General Electric excitor-generator coupled to a Westinghouse turbine. The Generrex is a main generator excitor regulating device for producing the main generator field and is manufactured by General Electric Company {G080}. The Generrex Exciter system has two +/- 15 volt power supplies {RJX} (+/-15V/#1, +/-15V/#2) that are independently regulated by means of their own circuit cards. The power supplies are used to operate voltage sensitive electronics in the Generrex system.

On November 15, 2006, at 16:26 hours, a four hour non-emergency notification was made to the NRC (Log Number 42993) for a reactor trip while critical and the notification included the eight hour non-emergency notification for actuation of the AFW system. The RT was reported under 10 CFR 50.72(b)(2)(iv)(B) and the AFW actuation reported under 10 CFR 50.72(b)(3)(iv)(A). The event was recorded in the Indian Point Energy Center corrective action program (CAP) as CR-IP2-2006-06658.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

CAUSE OF EVENT

The direct cause of the RT was a TT from actuation of the generator 86P lock-out relay. The apparent cause of actuation of the 86P lock-out relay was believed to be a momentary loss of the electrical ground to the alarm cards that monitor the primary and redundant power supplies for the Generrex exciter system. As a result of Hi output alarms received on the Generrex Exciter power supply in August and September 2006, troubleshooting was performed which revealed that high-resistance connections had been causing unreliable operation of the regulator circuit card. The circuit card has tin-plated steel sleeves on it that mate to connection pins on the main power supply chassis. Investigation of the connection pins showed that oxidation residue build-up was the cause of these deficient connections. After cleaning and lubricating the pins with anti-oxidizing gel the system operated normally. Subsequently, during the week of November 6, 2006, alarms returned for which a recorder showed were the result of erratic operation of the +15 volt #1 Power Supply. The erratic operation of power supply #1 was also causing power supply #2 to react in the same way. Engineering determined the most reliable fix until the next refueling outage would be to install soldered wire jumpers that would bypass the high resistance connections. This fix involved pre-fabricating a new circuit card with soldered permanent connections to the affected electrical points. On November 15, 2006, with the #1 power supply out of service (locking in one out of two trip signals) I&C Technicians were in the process of taking as-left pin resistance measurements after successfully replacing the circuit card with the modified card when a momentary low output spike caused the alarm logic to satisfy the two out of two trip logic and generated a trip signal to the 86P lock-out relay. The resistance measurements were on a pin electrically connected to a common ground.

A possible contributing cause was mechanical vibration of the Generrex power supply #1 which could have loosened the common ground terminal screw since its installation in refueling outage cycle 16 in November 2004. Engineering determined that the #1 power supply vibrates and the vibrations could be a result of improper manufacturing of the #1 power supply by General Electric. As the Generrex system is no longer in supply, this power supply was fabricated from schematics and not refurbished from one of the original power supplies.

CORRECTIVE ACTIONS

The following corrective actions have been or will be performed under the CAP to address the causes of this event and prevent recurrence.

- The Generrex +15V Power Supply common ground terminal screw and loose wiring were properly connected and tested. The +15V/#1 Power Supply repair and testing was completed. All remaining +/-15V Power Supply terminal points and pins were checked for proper operation. After successful testing was performed the system was returned to service.
- An extent of condition review determined that the condition applies to the other power supplies in the Exciter cabinet as they both were replaced during recent refueling outages. Engineering believes the #1 power supply is vibrating at a much higher rate due to being improperly manufactured. The #2 power supply does not exhibit this vibration and therefore does not have the same level of risk based on the suspected contributing cause.
- The Generrex +/-15V/#1 Power Supply will be replaced with a refurbished original power supply. Replacement of the #1 power supply is scheduled for March 2007.

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NARRATIVE *(If more space is required, use additional copies of NRC Form 366A)* **(17)**

EVENT ANALYSIS

The event is reportable under 10CFR50.73(a)(2)(iv)(A). The licensee shall report any event or condition that resulted in manual or automatic actuation of any of the systems listed under 10CFR50.73(a)(2)(iv)(B). Systems to which the requirements of 10CFR50.73(a)(2)(iv)(A) apply for this event include the Reactor Protection System (RPS) including RT and AFWS actuation. This event meets the reporting criteria because an automatic RT was initiated at 1400 hours, on November 15, 2006, and the AFWS actuated as a result of the RT due to a SG low level from shrink effect. This event did not result in loss of any safety function in accordance with 10 CFR 50(a)(2)(v) there not reportable under that criterion.

PAST SIMILAR EVENTS

A review of the past three years of Licensee Event Reports (LERs) for events that involved a RT from a Generrex Main Generator protective trip was performed. No LERs were identified. LERs that reported RTs as a result of main generator support system failures identified LER-2004-005. LER-2004-005 reported an automatic RT as a result of a TT due to a main generator trip caused by low stator cooling water pressure. The cause of the RT for LER-2004-005 was inadequate post work testing and inadequate operational procedural guidance for filling and venting the stator cooling water system. LER-2004-005 was the result of a generator support system but did not involve the generator exciter or its power supply. Therefore, corrective actions for LER-2004-005 would not have prevented the RT being reported by this LER.

SAFETY SIGNIFICANCE

This event had no effect on the health and safety of the public. There were no actual safety consequences for the event because the event was an uncomplicated RT with no other transients or accidents and the plant safely shut down as designed. Actuation of the AFWS is expected following full power reactor trips due to SG shrink effect which causes SG level to drop below a SG level trip set point. All required safety systems performed as designed in response to the RT.

There were no significant potential safety consequences of this event.
The generator protection system and reactor protection system is designed to actuate on anticipated combinations of plant conditions, when necessary, to ensure applicable safety analysis limits are met.